USDA Forest Service
Research Paper INT-87
1970

IMPROVEMENT AND MAINTENANCE OF CAMPGROUND VEGETATION IN CENTRAL IDAHO

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ABSTRACT

Vegetation in heavily-used campgrounds is often seriously depleted. When popular sites are rehabilitated, a combination of better campground design and better cultural practices can probably reverse this deterioration. At Point Campground in central Idaho, 2 years of treatment of a rehabilitated site produced substantial improvement of ground cover vegetation on units receiving water, fertilizer, and seed. Units receiving water and fertilizer, or water and seed, improved only slightly; seed alone produced no improvement. Although weekly watering required overnight closing of the campground, visitor acceptance was very good.

INTRODUCTION

The adverse ecological effects of people on recreation sites have been well documented (Meinecke 1928; Lutz 1945; Dotzenko, Papamichas, and Romine 1967; Magil and Nord 1963; and Ripley 1962). Improved design of sites and intensified cultural treatment can probably do much to minimize their impacts. A recent study (Beardsley and Wagar, in preparation) in Utah indicates relatively little loss of vegetation in a new campground after 4 years of fairly heavy use. This campground was designed to minimize visitor impact on vegetation. However, improved design and reconstruction of facilities alone might not be sufficient to allow natural revegetation on existing campgrounds. Therefore, it is important to develop techniques for protecting camping sites from further deterioration and to improve them whenever possible because most older and presently deteriorated campgrounds are at choice locations in scenic areas.

Successful upkeep of millions of home lawns, city parks, and golf courses using grass seed, water, and fertilizer indicate that vegetation can be maintained despite heavy use. Yet there is almost no published information that indicates grass or other vegetation can be successfully reestablished in old, badly deteriorated campgrounds. In Georgia, for example, Cordell and Talhelm (1969) reported that attempts to establish grass by seeding an old campground failed even after giving the planted areas the "best possible treatment for growth and survival." Although the seed germinated and a fairly dense stand of grass seedlings developed during early spring, virtually no grass remained on the test plots at the end of one full season of use by campers.

Establishing grass in public campgrounds is complicated by visitor use during the growing season. It is possible to close a campground while the new grass becomes established, and every few years thereafter to insure its continued survival. But total available campground capacity is limited. Closing one campground may simply shift the use load to adjacent campgrounds and worsen the ecological impacts. The heavy demand for recreation areas generally makes such closures prohibitive.

This paper reports the satisfactory results achieved at Point Campground on the Sawtooth National Forest in Idaho using improved design in association with seeding, water, and fertilizer. Although design alternatives were not studied, the apparent superiority of the layout of this reconstructed campground afforded favorable conditions for testing various vegetation treatments.

CAMPGROUND ENVIRONMENT

Located on scenic Redfish Lake in the Sawtooth National Forest, Idaho, Point Campground had been used for over 30 years so that by 1965, vegetation on the site was badly deteriorated.

This campground's popularity was established early because of nearby salmon and trout fishing opportunities, but early use was light. In 1936, the camp was expanded and improved under the Civilian Conservation Corps program. More or less typical for campgrounds of that day, it contained water hydrants, a pit-toilet, six elaborate stone fireplaces, and a varying number of movable wooden picnic tables.

Lodgepole pine (*Pinus contorta*) was and still is the predominant tree cover for the area; Douglas-fir (*Pseudotsuga menziesii*) and aspen (*Populus tremuloides*) are found occasionally. The lodgepole pine overstory trees are approximately 100 years old and have rather thin, small crowns. Dwarfmistletoe apparently infected the stand during its early years and now affects virtually every tree.

Figure 1.--*Point Campground, Sawtooth National Forest, 1963. Trampling had eliminated nearly all vegetation except that protected by trees.*

The campground is located on a gently rolling outwash terrace remnant at the toe of a steep lateral moraine. Slopes vary from 5 to 15 percent. Soil materials are dominantly of mixed granitic composition. Depth to bedrock is at least 15 feet everywhere in the campground (Arnold 1966).

Two distinct soil types are found: (a) a well-drained sandy loam, and (b) a moderately well-drained fine sandy loam. The sandy loam soil is on the upper portion of the terrace, generally 12 feet or more above the lake surface. Typically it has 15 percent coarse rock surface fragments. The water table for sandy loam soil is usually more than 10 feet below the surface.

The fine sandy loam soil occurs on the lower portion of the terrace. Here depth to the water table is generally 3 to 5 feet during the fall season. Undoubtedly the water table is higher during early spring. The coarse rock content of the soil on this lower portion of the terrace is much lower and its water holding capacity is greater than that of the soil on the upper portion of the terrace.

Both soils exhibit low erosion and compactibility potentials. Laboratory tests showed a low fertility level for herbaceous vegetation production and indicated a need for fertilizer, especially nitrogen.

Annual precipitation averages about 15 inches, more than half of which falls as snow. Temperatures are generally cool because the campground is at an elevation of 6,500 feet. Mean annual temperature is 35° F.; an average of 10 frost-free days can be expected each summer.

Judging from the surrounding area this combination of climate and soil never produced a particularly lush herbaceous ground cover or dense shrubbery. The most frequent understory species found today are pinegrass (*Calamagrostis rubescens*), elk sedge (*Carix geyeri*), strawberry (*Fragaria* sp.), low huckleberry (*Vaccinium* sp.), spiraea (*Spiraea lucida*), big sagebrush (*Artemisia tridentata*), buffaloberry (*Shepherdia argentea*), bitterbrush (*Purshia tridentata*), and gooseberry (*Ribes* sp.). Occasional clumps of alder (*Alnus tenuifolia*) and willow (*Salix* sp.) grow near the edge of the lake. Heavy use over much of the area had eliminated virtually all understory vegetation. Isolated patches could be found near rocks or trees where the vegetation had been protected from humans and vehicles (fig. 1).

REHABILITATION PROGRAM

Because of its generally rundown appearance and outmoded facilities, Point Campground was rehabilitated during 1966 and 1967. The rehabilitation plan was based on the explicit assumption that ground-cover vegetation could not be maintained on certain heavy-use portions of the campground. Accordingly, roads, parking spurs, trails, and a "facility pad" (for a table, fireplace, and charcoal grill) were surfaced with a gravel-asphalt mixture. In addition, a "tent pad" was located adjacent to the "facility pad"; this consisted of a 16- by 16-foot redwood frame filled with coarse sand (fig. 2).

The size and shape of the "facility pad" and parking spurs were contingent upon such factors as location of trees and ground slope. As a result, the total surfaced area within individual units (including the tent pad) ranged from 646 square feet to 1,572 square feet--an average of 1,188 square feet per unit.

An underground pipe system was installed to deliver water to a single sprinkler head at the approximate center of each unit. Water pressure and flow were adequate to sprinkle all eight camping units simultaneously.

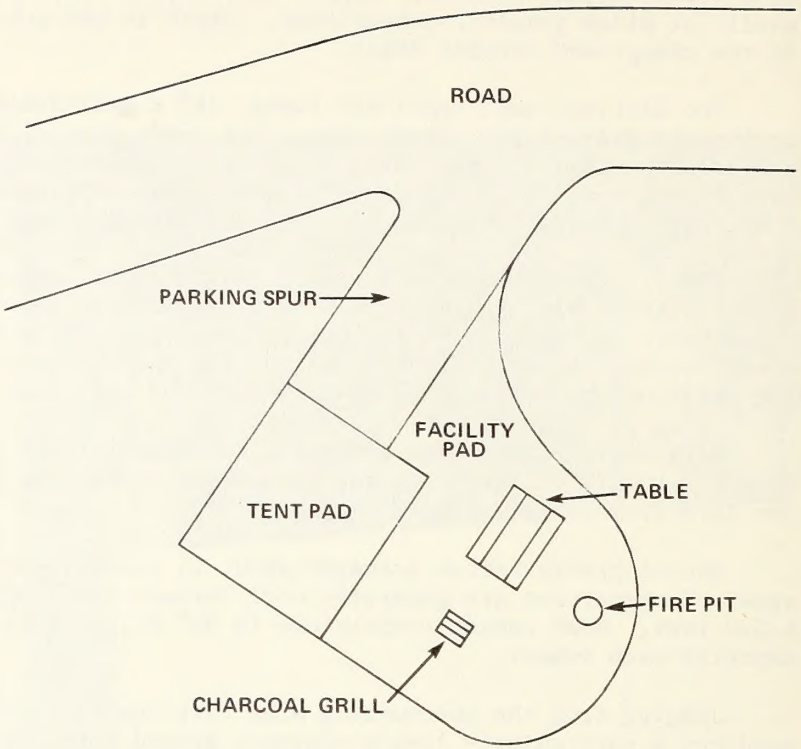

Figure 2.--*Layout of typical unit at Point Campground, Sawtooth National Forest.*

The entire campground was closed during construction for the 1966 and 1967 seasons. This permitted replacement of tables, fireplaces, and charcoal grills, as well as installation of a water hydrant system and central flush toilets. The campground closure was continued until July 1, 1968, to give the seeded grass more time to become established.

HOW TREATMENTS WERE APPLIED

Four cultural treatments were applied to 16 units during the 1968 and 1969 growing seasons: (1) grass seed only (control); (2) water and seed; (3) fertilizer and seed; and (4) water, fertilizer, and seed. Variations between the apparent plant growth potential of the soil on the upper and the lower portions of the terrace dictated a block design for the study. Fortunately, eight units could be located on each of the lower and upper sites of the terrace. Each treatment was randomly assigned to two units on the upper site and two units on the lower site. The treatment area around each unit consisted of an 85-foot square area that included the "facility pad" and "tent pad."

During June of 1968 grass seed, trees, and shrubs were planted. Indigenous tree and shrub seedlings were moved with a soil ball to the campsite from an adjacent area. They were planted in locations selected to block discontinued paths and roads. An unknown quantity of Kentucky bluegrass (*Poa pratensis*) seed was broadcast over all parts of the campground where the soil had been disturbed during construction--road ditches, pipeline trenches, and any fill around parking spurs or table pads. Discontinued roads were tilled and seeded. Seed was raked by hand into the soil.

HERRINGTON ROSCOE B. and BEARDSLEY WENDELL G.

1970. Improvement and maintenance of campground vegetation in central Idaho. USDA Forest Serv. Res. Pap. INT-87, 9 p., illus.

Two years of treatment using seed, fertilizer, and water produced substantial improvement in ground cover vegetation on a deteriorated campground in Idaho.

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In May 1969 a mixture of equal parts (by weight) of hard fescue (*Festuca ovina* var. *duriuscula*), Kentucky bluegrass, Dutch clover (*Trifolium repens*), and sodar wheatgrass (*Agropyron saundersii*) was applied at a rate of 40 pounds per acre. Seed was broadcast with particular attention being given to bare soil areas. Where needles formed a mat over 1 inch deep, they were raked aside and the seed spread over the underlying mineral soil. Mulch was not applied to any of the seeded areas.

The eight units that were fertilized each received a total of 45 pounds of nitrogen, 7 pounds of phosphate (P_2O_5), and 3.5 pounds of potassium during the two growing seasons. (On a per-acre basis, these quantities were equivalent to 315 pounds of nitrogen, 49 pounds of P_2O_5 and 24.5 pounds of potassium.) Roughly one-third of this total amount was applied in two applications (one in June and one in September) in 1968 while the young grass seedlings were becoming established. The remainder was applied in two applications (one in May and one in June) in 1969.

Each of the eight irrigated units received at least 1 inch of water weekly during each season over a circular area 110 feet in diameter.[1] This quantity of water tripled the moisture normally available from summer rainfall. The watered units were so located that neither overland water flow nor drifting spray could reach units not scheduled for irrigation. However, the water could not be evenly applied to all parts of the plot because of interference from standing trees.

Application of the weekly water treatment was complicated by the presence of visitors using the campground. To avoid drenching tents and other camping gear, all visitors were required to leave the campground with their equipment by 2 o'clock each Tuesday afternoon. Signs as well as brochures were used to inform campers of the need for the 1-day closure of the campground and the purpose of the irrigation program. The entire campground was reopened at 8 o'clock on Wednesday morning at which time all units were available on a "first-come-first-served" basis. Surprisingly few complaints were received over the weekly closure, perhaps because other nearby campgrounds were available or because of the efforts made to explain the program to visitors. In any event, the weekly closure of this campground did not produce any discernible public hostility.

HOW EFFECTS WERE DETERMINED

Vegetative and other ground cover conditions were sampled at 1-foot intervals along each of 10 permanent, equally spaced, 85-foot line transects within each unit. Each sample point was judged as falling within one of the following nine ground cover condition categories: (1) trees (low branches, exposed roots, etc.); (2) shrubs; (3) grass; (4) herbaceous vegetation; (5) litter (dead plant residue); (6) bare soil; (7) rock; (8) man-installed facilities; and (9) miscellaneous (nonnatural material such as glass, bottle caps, etc.).[2] The quantity of vegetation at each unit was initially measured in mid-September of 1967 following completion of any construction activity that might have disturbed vegetation. It was remeasured twice--in mid-September of 1968 and in mid-September of 1969. Figure 3 shows an example of change that occurred on a unit that received water, fertilizer, and seed.

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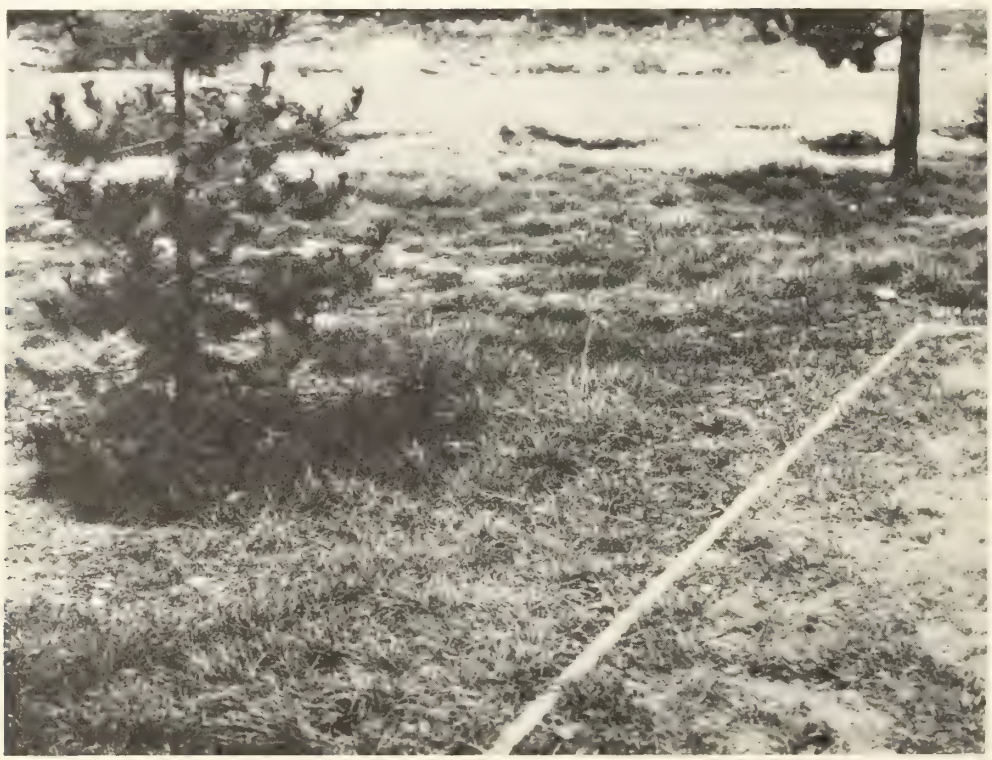
[1]Because of pressure variations, the amount of water could not be completely controlled. Individual units received between 1.1 and 2.6 inches of water weekly.

[2]The first four conditions were noted only for those portions of the vegetation which were 1 foot or less in height.

BEFORE
(1967)

Figure 3.--*Before-and-after treatment photographs show substantial increase in ground-cover vegetation on units that were watered and fertilized as well as seeded.*

AFTER
(1969)



The sample of 850 points within each unit allowed rather precise estimation of the proportion of the surface area of that unit falling within each category. For example, the true proportion of a unit in one ground-cover category would lie between 2 and 8 percent (at the 95-percent level of confidence) if the sample estimate was 5 percent.

RESULTS

By the end of the second season of growth, units treated with water, fertilizer, and seed had noticeably more grass and other herbaceous vegetation than units that had been treated only with seed (control units). Differences between the other treatments were recognizable but less obvious. In general, statistical evaluation of the measurement data confirmed these observations.

Analysis of variance of the data showed that the covariant, visitor use, was non-significant. Therefore, the means for various treatments did not require adjustment for differences in visitor use between units. The model accounted for 95 percent of the total variation in measurements of vegetation growth (R^2). The majority--85 percent of the total--was attributed solely to the main effects of treatment. In other words, treatment accounted for the major portion of all squared differences from overall mean growth.

Tests of significant differences between the treatment means by Scheffé Test (Bancroft 1968) indicated no differences between the sites. That is, treatment responses were not influenced by site. Treatment responses were found to be markedly different from one another at the 95-percent level of significance.

(1) Most important, the water-fertilizer-seed combination produced significantly more vegetation than any of the other treatments.

(2) Water and seed produced significantly more than seed alone.

(3) Fertilizer and seed together were not significantly different from seed alone (control).

The average change in proportion of ground cover vegetation for each of the four treatments is listed below and presented in figure 4.

Treatment	*Growth*[3]
Water, fertilizer, seed	40
Water, seed	11
Seed, fertilizer	6
Seed	-1

The control units, which show a slight decline in ground cover vegetation since the campground was reopened for use in 1968, will probably stabilize at some rather low level of vegetation.

[3]Change in percent of vegetative cover of total available area. For example, the seed (control) treatment decreased from 8 percent in September 1967 to 7 percent in September 1969.

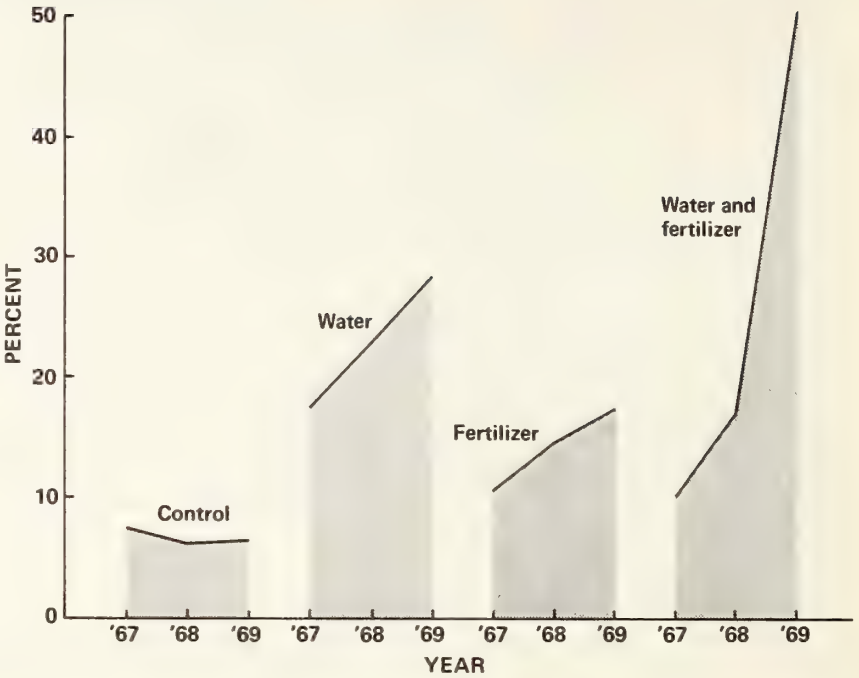


Figure 4.--*Percent of available growing space covered by grass, shrubs, and herbs. Available growing space includes all portions of the unit except pad, parking spur, trails, rocks, trees, and tree stumps. (All units received grass seed.)*

CONCLUSIONS

It is undoubtedly premature to attempt to project the time required to achieve a satisfactory level of ground cover with the various treatments. Data for two seasons of growth are not conclusive. Nevertheless, the dramatic results achieved with water, fertilizer, and seed strongly suggest that a satisfactory level of ground cover can be expected at the end of the third full growing season. Rates of change observed so far indicate that, without water, it could take 20 years or longer to revegetate a badly worn campground, as shown in the following tabulation:

Treatment	*Years required to produce 70-percent cover*
Seed only	Never
Fertilizer and seed	At least 20
Water and seed	At least 10
Water, fertilizer, and seed	At least 3

These time estimates assume that: (1) 70-percent ground cover is adequate and realistic; and (2) the vegetation will continue to improve at the same rate as was observed during the 2-year study period.

REFERENCES

Arnold, J. F.
1966. A soil survey report for the Point Campground on Redfish Lake. USDA Forest Serv., Intermountain Region, Office Rep.

Bancroft, T. A.
1968. Topics in intermediate methods. Vol. 1, p. 109. Ames: Iowa State Univ. Press.

Beardsley, W. G., and J. A. Wagar.
Vegetation management on a forested recreation site. USDA Forest Serv., Intermountain Forest and Range Exp. Sta. (In preparation.)

Cordell, H. K., and D. R. Talhelm.
1969. Planting grass appears impractical for improving deteriorated recreation sites. USDA Forest Serv. Res. Pap. SE-105.

Dotzenko, A. D., N. T. Papamichas, and D. S. Romine.
1967. Effect of recreational use on soil and moisture conditions in Rocky Mountain National Park. J. Soil and Water Conserv. 22(5): 196-197.

Lutz, H. J.
1945. Soil conditions on picnic grounds in public forest parks. J. Forestry 43: 121-127.

Magill, A. W., and E. C. Nord
1963. An evaluation of campground conditions and needs for research. USDA Forest Serv. Res. Note PSW-4.

Meinecke, E. P.
1928. A report on the effect of excessive tourist travel on the California Redwood Parks. Calif. State Printing Office.

Ripley, T. H.
1962. Recreation impact on southern Appalachian campgrounds and picnic sites. USDA Forest Serv., Southeastern Forest Exp. Sta. Pap. 153.

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